TUNNELING CONFERENCE SUMMARY

BACKGROUND

The California High Speed Rail Authority (HSRA) is in the formal environmental approval process for the implementation of a statewide high-speed train system serving the state's major population centers. To connect these centers the high-speed train system would have to traverse the Tehachapi Mountain range between Los Angeles and Bakersfield, the Diablo Mountain range between the San Joaquin Valley and the San Francisco Bay Area and numerous other areas with difficult terrain creating the need for extensive tunneling to accomplish the necessary alignments. Alignments are under consideration that would require a total of over 80 miles of twin-tube tunneling, including the potential for continuous tunnel segments of over 30 miles in length. Crossing the Tehachapi Mountains between Los Angeles and Bakersfield could require 30-45 miles of tunneling in extremely challenging seismic and geologic conditions. These mountain crossings and the required tunneling represent challenges to the construction of the system. Relative certainty and confidence in the feasibility of the proposed tunneling and associated cost estimates is critical to the planning decisions currently being considered.

TECHNICAL CONFERENCE

To provide a forum to address the issues associated with the tunneling required for the statewide high-speed train system, a technical conference was held on December 3 and 4, 2001, in the Los Angeles area. The conference was attended by seven representatives of major tunneling contractors, nine specialized tunneling consulting engineers, two geologists/geotechnical engineers, and representatives of the Program Management and Regional Study Teams as well as Authority staff. In addition, the first day of the conference was observed by two Authority Board Members. The conference was held over a two day period providing sufficient time for extensive discussion in the three main areas: past assumptions and requirements, construction methods and cost estimating.

The conference focused on gaining insights/input regarding feasibility, construction methods and cost assumptions associated with the proposed tunneling. This information will be used in making planning decisions that are based on the current construction capabilities or those reasonably expected within the implementation timeframe of this project. The attendees were provided with background information on the studies to date, system requirements, previous assumptions, and previous findings as a basis for participation in the technical conference. As part of the conference, attendees participated in discussions and cost estimating exercises to identify and explore the key issues.

CONCLUSIONS

Based on the outcome of the discussions held throughout the conference, numerous specific conclusions were formalized with all of the attendees. Several of the key conclusions are summarized below.

- Confirmed the overall feasibility of the tunneling proposed for the statewide high-speed train system. No 'fatal flaws' were identified in the tunneling assumptions applied to date.
- Tunnel boring machines should be assumed as the excavation method for all tunnels with the exception of specific areas identified during the conference that have difficult geology.
- Twin single track tunnels should be assumed for lengths of 0-6 miles. For lengths greater than 6 miles a third tunnel is required for ventilation, evacuation and construction access.
- There is no significant difference in the tunneling requirements (methods or cost) at sustained 2.5% or 3.5% vertical grades.

- The cost of tunneling using Tunnel Boring Machines versus Drill and Blast methods was not as significant as the difference in construction time. Drill and Blast methods require significantly more time.
- All tunnels should be fully lined for structural, water tightness and aerodynamic reasons.
- Considerable geologic exploration is required prior to construction.
- Consider reducing the cross-sectional area of tunnels approaching terminal stations and evaluate potential reductions in other areas. Tunnel cost is directly related to the diameter of the tunnel, which is determined by the design speed through the tunnel.
- Confirmed the desirability of crossing of major fault zones at grade.
- Confirmed the objective of minimizing the amount of tunneling required, due to cost, time of construction and potential for delay.
- Limit the use of long tunnels (over 12 miles in total length).

The conclusions reached at the conference generally confirm and support the studies completed to date. Conclusions representing new information or direction will be incorporated into the screening evaluation as appropriate.

Tunneling Conference
California High-Speed Rail Authority
December 3 - 4, 2001

COMPANY	ATTENDEE	TITLE
Tunneling Contractors		
Modern Continental South, Inc.	Bill Thompson	Heavy Construction Manager
Frontier Kemper	Dave Rogstad	Northwest Division President
Taylor Brothers	George Williamson	Underground Division Manager
Atkinson Construction	Alan Adams	Manager of Estimating
Kiewit Construction	Niels Kofoed	Tunnel Project Engineer
Obayashi Corporation	Michael Gowrine	Project Sponsor, Heavy/Civil Operations
Shea Construction	Ed Marcus	Tunnel Project Manager
Tunneling Consultants		
Hatch Mott MacDonald	John Townsend	Vice President, Transportation and Tunnels
UCIC Consultants, Inc.	Hugh Cronin	President
Independent Consultant	Dennis McCary	Tunneling Engineer
Maunsell House	Bob Frew	Technical Director, Tunnels
Independent Consultant	Dick Roberts	Tunneling Engineer
Regional Team (Los Angeles to Bakersfield)		
P&D Consultants	Sylvia Salenius	Project Manager
DMJM & Harris	Dru Desai	Tunneling Engineer
DMJM & Harris	Vic Stevens	Rail Engineer
DMJM & Harris	Rachel Vandenberg	Engineering Lead
Kleinfelder	Bruce Hilton	Engineering Geologist
Regional Team (Bay Area to Merced)		
Parsons Transportation Group	Dave Mansen	Project Manager
Geotechnical Consultants, Inc.	Neal Mace	Engineering Geologist
Program Management Team		
Parsons Brinckerhoff	Kip Field	Project Manager
Parsons Brinckerhoff	Tony Daniels	Chairman, Transit & Rail Systems
Parsons Brinckerhoff	Bill Kennedy	Deputy Technical Director, Tunnel Ventilation
Parsons Brinckerhoff	Paul Moiser	Rail Operations Engineer
Parsons Brinckerhoff	Jim Monsees	Technical Director, Underground Engineering
CA HSRA Staff		
California High-Speed Rail Authority	Mehdi Morshed	Executive Director
California High-Speed Rail Authority	Dan Leavitt	Deputy Director
California High-Speed Rail Authority	Carrie Pourvahidi	Deputy Director